Using science to inform decisions

Knowing how and when to use different types of evidence and advice will help you with decision-making when creating policy. We value science and scientific advice, and the contribution it makes to policy development and delivery.

Science is not the only type of evidence you should consider. Other types of evidence include:

economic or financial information
environmental regulations and requirements
legal advice
public opinion (including the results of consultation exercises)
statistical data

There are close links and principles shared with the other analytical professions within government - economics, statistics, social science and operational research.

Science-informed policy development involves using scientific evidence and advice as one strand of evidence in the decision-making process. It can range from using a piece of research done inside or outside government, to consulting the Chief Scientific Adviser on a particular issue.

View our science standards and assurance in Scottish Government.

Why science advice matters

New developments in science and technology don't just affect our daily lives. They can also affect how we develop and deliver policy, and what those policies are.

Science advice and scientific evidence can be used by – and add value to – all policy areas, not just those traditionally associated with science, or where there are already scientists working in the Scottish Government.

Adopting an evidence-informed approach can help improve policy development by:

reducing uncertainty and increasing clarity
providing new perspectives and understanding about the policy challenge
increased accountability to stakeholders and the public
reducing risk
giving assurance around value for money

When our work is informed by science, it ensures that commitments and targets are robust and achievable, based on the science and technology available now and in the future.

A clear evidence trail that has informed policy backs up our commitment to openness and transparency. It can also help to avoid the need to change policies significantly in light of new developments.

Sources of science advice

You can access many internal and external sources of science advice and evidence.

Internal sources

Internal sources include more than 500 scientists and engineers working in:

Health
Marine Scotland
Science and Advice for Scottish Agriculture (SASA)
Transport Scotland
Drinking Water Quality Regulator and Food Standards Scotland
Scottish Forestry
Forestry and Land Scotland

There are also specialist senior advisers (and their support teams) in key professions, including:

Chief Veterinary Officer
Chief Medical Officer
Chief Statistician and Data Officer
Chief Researcher
Chief Information Officer
Chief Social Policy Adviser

Other internal sources include:

science advisers, linking policy teams (particularly in the rural/environment portfolios) with scientists within the Scottish Government
the Chief Scientific Adviser (CSA) for Scotland, particularly for cross-cutting issues or where there's no existing portfolio-based in-house expertise
portfolio-based Chief Scientific Advisers (CSAs) - the Chief Scientist (Health), and the CSA Environment, Natural Resources and Agriculture
science and evidence unit, part of the Central Analysis Division
operational research, social research, economic analysis or statistical analysis teams across different portfolios within the Scottish Government

External sources

External sources of support include:

the Scottish Science Advisory Council (SSAC) – an independent panel of academic and industry specialists, with Scottish Government secretariat and CSA membership
Scottish Government funded research programmes – for example in the rural/agricultural areas
call-off contracts or a contracted project with a suitable organisation or network of academics
one-off contracts with a particular academic or a specially-convened expert panel
standing expert committees (at Scotland or UK level)

There are also Centres of Expertise in key areas:

Centre of Expertise on Animal Disease (EPIC)
Centre of Expertise on Climate Change – ClimateXChange (CXC)
Centre of Expertise for Waters (CREW)
Centre of Expertise on Plant Health

The best ways to access advice will depend on what you need, how quickly you need it, and what resources you already have. You should use a clear and considered process to make an informed choice that gives you what you need.

Commissioning scientific research, evidence or advice

If you need to commission scientific research or advice, you should follow good practice principles. For example, be proactive in your planning. Plan out your information needs. Plan out the various stages for each individual project from the start, including how you will use and publish the outcomes. Good planning will save time, money and effort in the long run, so keep a record of your plan.

You should also be creative and multi-disciplinary rather than single-minded. Consider the different areas of advice that might be relevant for your issue.

It's also important to engage early with internal and external stakeholders to help frame your objectives. You might find a colleague who is already involved in a project can help provide the advice you need.

Be clear about:

what you want - frame your question clearly, so that the person/body providing advice knows what you need and what they need to provide
your available resources - what budget and staff resources do you have to support this work, and how might it affect who you approach for advice

your timescale - having a clear timescale in mind helps you and your adviser, and how quickly you need the advice might affect where you get it from

You should try to maximise value for money. This isn't just about good value contracts. Make sure you consider internal sources of advice, if appropriate, before thinking about commissioning external experts at a cost.

You should ensure openness and transparency. It's good practice to publish the advice you commission, and explain how it was commissioned. Having a clear process in place helps to achieve this, in the spirit of the Scottish Government's commitment to open government.

Make sure you evaluate. It's useful to evaluate evidence, so keep a record of what contribution it made. What have you learnt from the process? Is there good practice to carry forward or things to change for next time?

Read further information about commissioning:

making sure you ask the right question
thinking about quality assurance
transparency and communication
evaluation

Case studies - using science advice

Marine Scotland – planning

Marine Scotland's Marine Offshore Renewables Team recognised that their processes for identifying and commissioning research and advice to inform decision making was reactive. This approach meant there was not always time to engage widely with a diverse range of stakeholders, make connections and build collaborations with appropriate partners. Lacking a clear list of priorities also made it harder to influence and inform research funders at both UK and European level.

The team decided to set up an inclusive framework that engaged the main stakeholders in a variety of specific areas to identify and prioritise research needs. This included an oversight group of senior decision makers to prioritise across receptor groups and identify possible collaborative opportunities.

Groups were established with common templates. These were to produce evidence maps, to list priorities and develop a formula to standardise the prioritisation process across all groups.

Collaboratively producing evidence maps has enabled better strategic planning of resources, now and for the future, realising joint commissioning and funding opportunities. This approach has lowered the risk of duplicating research and increased overall value for money. It has improved Scottish input into new UK and EU funding programmes and improved stakeholder relationships.

Planning science advice and evidence requirements has enabled the creation of a long term vision and allowed time to consider more innovative ways to address these needs. We increased our impact internationally by sharing our planning processes, levering funding and broadening collaborative opportunities in Scotland, UK and internationally.

Unconventional oil and gas

The Scottish Government took an evidence-led approach to unconventional oil and gas. It established an Independent Expert Scientific Panel to examine the evidence on unconventional oil and gas. This includes hydraulic fracturing, or 'fracking', and coal bed methane extraction.

The panel reported its findings in July 2014. After considering its findings, a moratorium on onshore unconventional oil and gas was introduced. This was to explore the specific issues and gaps in evidence identified by the panel, and to undertake a comprehensive period of public engagement and dialogue.

In early 2016, the Scottish Government commissioned further independent research reports to address the evidential gaps identified by the panel. The reports, covering health, economic and environmental matters, allowed us to consider further independent expert scientific advice. This included advice from the British Geological Survey, Health Protection Scotland, and the UK Committee on Climate Change.

The following research studies were commissioned in 2016:

economic impacts and scenario development (KPMG)
climate change impacts (Committee on Climate Change)
understanding and monitoring induced seismic activity (British Geological Survey)
transport - understanding and mitigating community level impacts (Ricardo)
decommissioning, site restoration and aftercare – obligations and treatment of financial liabilities (AECOM)
health impact of unconventional oil and gas in Scotland (Health Protection Scotland)

The research reports were published in full in 2016, and were followed by a public consultation in 2017, the findings of which were also published. This created a comprehensive evidence base for ministers to use.

Space and satellite technologies

The Scottish Science Advisory Council (SSAC) identified the Scottish space industry as an area of interest. It was keen to provide a briefing note for the Scottish Government, identifying opportunities for university research, business, innovation and STEM learning in schools, as well as for the Scottish Government itself.

The lead SSAC member for the project was able to pull together key information. He then met relevant Scottish Government officials to discuss emerging issues and possible recommendations, to gauge their feasibility, and how they might fit in with ministerial support for the industry.

The final briefing note was used by the minister at a reception to celebrate the Scottish space sector, and to highlight key successes, challenges and possible future developments. The note was also welcomed by the sector as the impetus to form a new leadership group.

Coronavirus (COVID-19) certification

In September 2021, the Scottish Government considered the introduction of a mandatory domestic COVID-19 vaccine certification scheme. We needed to demonstrate a strong evidence base to ensure it would be fit for purpose and to alleviate ethical concerns. We adopted an extensive and highly collaborative approach which provided data and evidence from across the analytical professions. These include:

behavioural scientists
economists
epidemiologists and modellers
biologists
social researchers
statisticians

The Central Analysis Division (CAD) was responsible for collating and producing that evidence base. They also put forward the idea of publishing a paper to support transparency and to ensure stakeholders understood the position. The CAD published these two papers:

Coronavirus (COVID-19) vaccine certification: evidence paper
Coronavirus (COVID-19) vaccine certification: evidence paper update

Both papers adopted a four harms approach, considering:

The direct health harms of COVID-19.
The indirect impact on our health and social care services.
Societal impacts.
The direct impact on the economy.

Clinical data highlighted the current state of the epidemic. Epidemiological modelling showed additional measures were required to help reduce infection and subsequent hospitalisations as we

moved into winter. We looked at topics such as:

vaccine effectiveness
SARS-CoV-2 transmission in a range of settings
the effectiveness of various non-pharmaceutical interventions (NPIs) on reducing transmission

Analysis of this scientific literature informed us that vaccine certification could assist as part of a package of measures.

Research into recent public attitudes highlighted both the benefits and concerns of a vaccine certification scheme. The economic impact of introducing a certification scheme wwere considered within the extensive analysis. The impact highlighted the increased administrative costs for the businesses it would affect. International evidence from countries that had previusly introduced mandatory domestic COVID-19 certification provided inconclusive findings on the overall benefits. We found it depended on the scope of the scheme and the vaccine uptake at the time of its implementation.

The vaccine certification evidence paper was balanced in its interpretation of the findings. It provided a comprehensive analytical evidence base to inform policy colleagues and ministers of both the pros and cons of introducing the scheme. Due to the paper's findings, policy colleagues adopted a cautious approach when implementing the Scottish domestic vaccine certification scheme on 1 October 2021. Based on the complex evidence provided in the paper, only settings considered higher risk were included in the certification scheme. We therefore adopted a less economically impactful scheme compared to other countries, while also permitting higher risk settings to remain open.

We also agreed to undertake an early evaluation of the effectiveness of the scheme. This is because there were ethical and economic concerns highlighted in the evidence paper. There was also inconclusive scientific and behavioural evidence regarding the scheme's overall benefits. A second vaccine certification evidence paper was published on 19 November 2021.

The scheme was modified on 6 December 2021, based on findings reported within the second evidence paper. A negative Lateral Flow Device (LFD) test for COVID-19 was included as an alternative to proof of vaccination. The Scottish domestic vaccine certification scheme ended on 28 February 2022. By this point, analysis of the epidemiological data indicated that trends were improving.

An independent expert gave evidence to the COVID-19 Recovery committee the day after the publication of the first paper. Professor Christopher Dye from the University of Oxford said it was "a good report" and he "broadly agreed" with its recommendations. The substantial evidence base collated within both papers was also used to defend the Scottish Government's decision in court during a Judicial Review.

Science in policy champions

Science in policy champions are colleagues with an interest in science who maintain links with the support team for the Chief Scientific Adviser (CSA) for Scotland.

You can contact the champions in your area if you need advice about science evidence and advice.

They can provide guidance to suit your team, whether you are looking for science advice for the first time, or have established routes to gain science advice or evidence. You should also contact them if you're wondering how to obtain data or use the data you have.

Science in policy champions will support the use of science advice and evidence in their area by:

answering basic enquiries about science advice and evidence (for example, signposting colleagues to current guidance and CSA team contacts)
supporting policy colleagues exploring options for procuring science advice, including developing commissions to take to the Scottish Science Advisory Council
interacting with other science in policy champions, to allow greater understanding of each other's work and build up good practice in science evidence and advice
attending the annual Scottish Government science conference, to network with Scottish Government scientists and science in policy champions, and hear directly from the CSA about current issues
promoting the use of science evidence and advice by highlighting the added value it can bring to policy development

Science in policy champions will also share knowledge, experience, examples and issues with science advice to the CSA and their team. This will enable us to monitor and evaluate the use of science advice in the Scottish Government. The information will be gathered by the CSA's team on a quarterly basis and fed back to senior staff.

Becoming a science in policy champion

If you're interested in how science advice and evidence are used in policy development and delivery, becoming a science in policy champion is a good opportunity to develop your skills and knowledge.

Champions will receive ongoing support from the CSA and their team and will be an important link between their directorate and the CSA.

The role should take up a maximum of an hour or two every month or so.

To find out more, please contact the CSA's team.

Further scientific help

The following contacts can provide further science advice or direct you to the right support.

Chief Scientific Adviser (CSA) for Scotland – Professor Julie Fitzpatrick

Julie can provide advice on a range of issues, whether you're looking for science input to a particular policy, or need a steer on a science policy issue. She can help with cross-cutting issues and areas where there are no other sources of advice. Julie is supported in her CSA work by the Scottish Science Advisory Council (SSAC). The SSAC is an independent expert panel that can be commissioned by policy teams to give advice, free of charge, on a range of topics. Read more information on the SSAC website and contact Julie if you have a query about her role and science advice.

Chief Scientist (Health) – Dame Anna Dominiczak

Anna gives advice primarily around the work of the Chief Scientist Office (CSO). The role of the CSO is to oversee all aspects of research in the health and care system in Scotland. You can contact Anna for advice on:

stakeholder relationships
cross-cutting issues
commissioning in connection with research in the health and care system

CSA Environment, Natural Resources and Agriculture – Professor Mathew Williams

Mathew provides advice around the work of Rural and Environment Science and Analytical Services (RESAS), such as the environment, agriculture and the wider rural economy. Mathew works closely with:

the Chief Veterinary Officer
Scotland's Chief Plant Health Officer
the Heads of Analysis and other similar professional post holders in agriculture, including the Head of Marine Science Scotland

This is to ensure that all scientific evidence and advice for policy/decision making is robust, relevant and high quality. For further information, contact Mathew's team.

Chief Veterinary Officer (Scotland) - Sheila Voas FRCVS

Sheila gives veterinary advice to Scottish Ministers and leads on animal health and welfare for Scotland. The role of the Chief Vet is to protect animal welfare, animal health and human health by preventing, controlling or eradicating notifiable diseases, including zoonotic diseases. Although primarily focussed on agricultural species, it also includes marine, companion and wild animals. Sheila is happy to be contacted about:

any aspects of animal health or welfare, including the role of animals in food security
climate change and antimicrobial resistance
matters relating to the vet profession itself

Chief Statistician – Ally McAlpine

In his role as the Chief Statistician, Ally McAlpine has overall responsibility for the coordination and implementation of professional standards that help maintain trustworthiness in the use of data and its quality, and how it is used to deliver improved outcomes for people in Scotland. In particular, he helps coordinate high professional standards that statistical staff follow to ensure the statistics are independently produced.

Chief Researcher – Dr Audrey MacDougall

Audrey is the Head of Profession for all the social researchers within the Scottish Government. In this role she promotes high quality research, setting standards and adjudicating on quality assurance. She is also responsible for recruitment, promotion training and development across the group. She has a small supporting team (Office of the Chief Social Researcher - OCR) and is based in area 2H North in Victoria Quay.

Audrey can help when natural science issues bump up against social issues, advising on how to integrate attitudinal or behavioural research to 'natural' science projects. Her team provides advice on consultation and public participation, research ethics, handling cross cutting issues and commissioning more generally. OCR also sponsors a range of cross government working groups which all scientists are welcome to join - contact them for more information.

Science and Evidence Unit

The Science and Evidence Unit provides science evidence on cross-cutting issues, on topics that are outside the specific remit of internal expert advisors. The team can help by providing summaries of scientific findings for contributions to briefings, FMQs and cabinet papers. We can provide a short summary of the evidence for a particular topic, or do a more thorough analysis and include conclusions and recommendations. We can provide evidence as written text, slide packs or infographics. For further information, contact the Central Analysis Division.

Science advisers in the environment/rural/agriculture portfolio areas

Rural and Environment Science and Analytical Services (RESAS) makes sure there is data, evidence and research in rural affairs, agriculture, food and the environment.

The science advisers and analysts in RESAS can help policy makers to identify and address their knowledge gaps or evidence needs. As part of building the multidisciplinary evidence base to underpin policies, RESAS also manages a wide range of research and knowledge exchange initiatives. These initiatives can help bring together experts and policy teams to develop solutions to both more immediate issues and longer term questions.

Chief Plant Health Officer for Scotland - Professor Gerry Saddler

Gerry has overall responsibility for maintaining and improving Scotland's plant health resilience, working across agriculture, forestry, horticulture and the natural environment. Gerry is also Head of Science and Advice for Scottish Agriculture (SASA). You can contact Gerry on issues relating to trade in plants and plant products, plant disease surveillance and outbreak response. For more information please email Gerry or follow @plantchiefscot on Twitter.

Chief Scientific Adviser for Food Standards Scotland (FSS) - Professor David Gally

David is an expert in microbial genetics at The Roslin Institute, University of Edinburgh. The CSA role is to ensure that FSS policy and decision making in relation to food safety, standards, diet and nutrition is based on sound science and evidence.

SASA is the Scottish Government division that provides scientific services and advice in support of Scotland's agriculture and wider environment. Although much of SASA's work is in support of arable agriculture, they also provide services in food safety, wildlife management and crime and specialist advice to ministers.

Marine Scotland Science (MSS) carries out a programme of monitoring and research, and regulatory and enforcement activities. It represents the Scottish Government at national and international meetings to support the policies and regulatory activities of the Scottish Government in managing Scotland's marine and freshwater resources. Specialists in natural sciences provide expert advice and services on issues relating to:

marine and freshwater fisheries
aquaculture
marine renewable energy
the aquatic environment and its flora and fauna

Get more involved with science

If you want to find out more, or get involved in science, you can:

come along to the Scottish Government Science in Government conference (date to be confirmed)
take part in Science and the Parliament or the Scottish Government Evidence in Policy Fortnight - these take place in November each year
look out for further announcements about science in policy champions and training opportunities
follow the Chief Scientific Adviser on Twitter - @ScotSciChief

Useful links

Scientific and engineering advice: guidelines for policy makers (UK) - guidance on the use of scientific and engineering advice in government.

Guide to Evidence for Policy (UK)

The role of Evaluation in Evidence Based decision making (UK)

Institute for Government – Evidence and Evaluation in Policy Making

UK Government Principles of Science advice to Government

UK Chief Scientific Advisers

Royal Society: Evidence Synthesis for Policy: Principles

Royal Society Policy Projects

Sense about Science – Transparency of Evidence Spot Check

The Royal Society of Edinburgh:

policy advice papers
policy inquiries
standing committees

Food Standards Scotland:

science checklist
science and evidence strategy